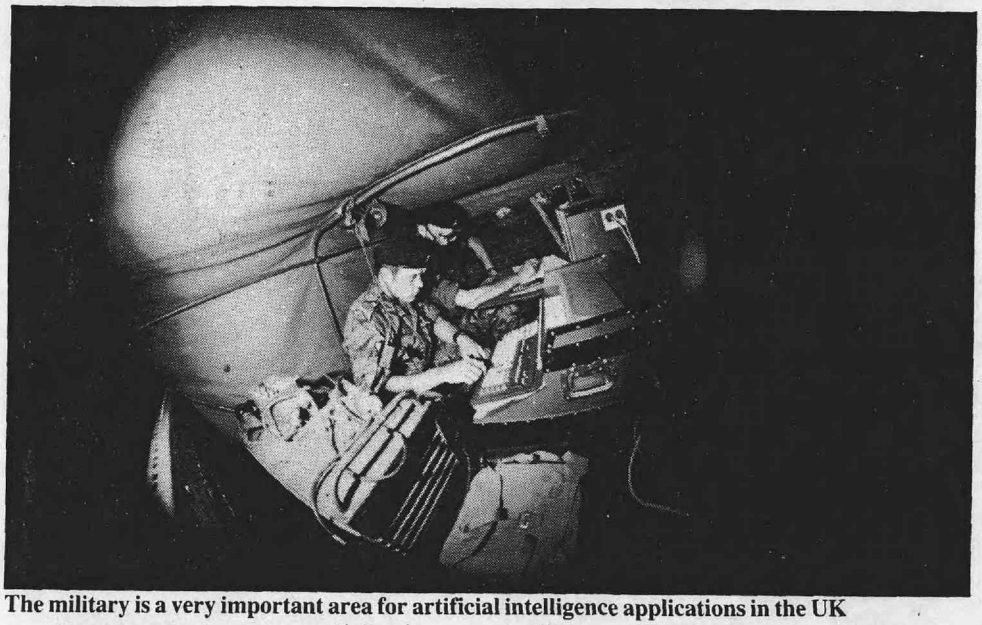
An anatomy of ai power



The military is a very important area for artificial intelligence applications in the UK

In the search for hardware that can deliver the power that ai users need Racal and Norsk Data have joined to develop a machine that could rival DEC's VAX, the traditional workhorse for ai research, writes Tony Durham

Following a disastrous attempt to sell expert systems to an unresponsive oil industry, the Racal group is launching a fresh attack on the artificial intelligence (ai) market, this time with hardware and programming tools.

One lesson the UK electronics and communications group learned from the Racal Expert Systems failure was that running a large knowledge-based system can bring a supposedly powerful computer to its knees.

In search of hardware that could take the strain, Racal approached Norwegian computer maker Norsk Data. The two firms have launched a £1 million joint venture, with Racal holding a 51% share.

The new company Racal-Norsk has based its plans on the following propositions. Serious knowledge-based systems are large. Large ones gulp computer power. Power is what the customers are going to want.

'We decided there was a real market need and requirement for a powerful ai machine, Lisp-based,' says sales manager John Lewis. The machine he plans to be producing by December is basically Norsk's 32-bit ND500, microcoded for symbolic processing, and packaged with the Zetalisp language and programming environment.

It is called the KPS-10 (KPS signifies Knowledge Processing System) and according to Lewis: 'We are estimating that it will be 10 to 20 times more powerful than a VAX for ai type processing.'

The only good news for Digital Equipment (DEC) in that remark is the acknowledgement of its VAX superminis as the standard for comparisons – even unfavourable ones. But Lewis expects DEC and IBM to enter the market for specialised ai machines in their own good time.

If he has judged both the market and the power of his machine correctly, then there are customers who will want, and get, several times the power of a VAX for each person using the system. A fairly basic KPS-10 configuration costing between £200,000 and £250,000 is expected to support four users.

Lewis argues that massive power is needed not only to develop but to run serious knowledge-based systems. 'In ai there are a lot of small problems which can be tackled with personal computers or work stations,' he says, 'but they are essentially trivial.'

Even such specialised ai work stations as the LMI Lambda and the Symbolics 3600 he dismisses as underpowered. Racal Expert Systems ran its oil industry package on the 3600, which in Lewis's view was not powerful enough for the job. That expert system contained many rules.

'To get really viable commercial ai systems the general feeling is you're going to have to have about 2,500 rules,' says Lewis.

Racal-Norsk is entering the market with a conventional von Neumann machine.

The ND500 does, however, have architectural features which recommended it for conversion into an ai machine. It has a large address space, and supports segmentation, a form of virtual memory which respects the natural structure of the data. This is a useful feature for object-oriented languages such as Xerox's Smalltalk or Zetalisp's Flavors.

The machine also has a writable control store. This makes it easier to add new instructions to the machine's microcode which will aid the efficient execution of particular languages or types of program. For the KPS-10, the control store is doubled in size, to 16K by 144 bits. Racal-Norsk's aim is to provide fast execution of Lisp, with the ability to run existing Norsk Data software at the same time.

The machine's central component is its multiport memory, with a maximum size of 2 gigabytes. Several processors can share this memory. More power can be added as demands on the system grow.

Another important hardware component is the graphics terminal made by Primagraphics of Cambridge. This provides the high resolution image that is required to make good use of Zetalisp's multiwindow display.

Zetalisp was developed from Maclisp at the Massachusetts Institute of Tech-

nology. It incorporates added comforts for the programmer, including object-oriented programming through Flavors, and an operating system which can display different activities in a number of windows on the screen.

'In the UK, Prolog is accepted as the other language of ai. (In the US, Lisp reigns supreme.)

'What we are going to do is to implement Prolog in Zetalisp,' Lewis explains. 'That doesn't mean Prolog is compiled into Lisp. Prolog will have its own microcode.' Certain other systems which translate Prolog code into Lisp rather than direct to machine code have been criticised for their inevitable slowness.

'One of the biggest advantages of Zetalisp is that the programmer productivity is enormous,' says Lewis. This he attributes to a combination of factors: the Lisp langauge itself; the human interface with screen windows and a mouse as pointing device; the editor, debugger and other programming tools; and incremental compiling, a technique which shortens the write-compile-debug loop.

In the US, Lewis points out, some customers have adopted Zetalisp for rapid prototyping of conventional dp software.

Financial institutions are seen as natural Zetalisp customers. Dealers who refer to a variety of prices, exchange rates and news services could use the windowing feature to get it all on one screen, instead of having their desks crowded with assorted terminals.

Expert systems could be grafted onto the financial systems later.

Racal is a major military contractor, and Lewis hopes for sales in that sector too. 'The military is without doubt the fastest growing area of ai applications in the UK,' he says.

The Norsk architecture will allow the machine to attach 32 tag bits to each 32-bit data word. Tag bits are considered useful for ai processing, and also for high-security computing, where they provide an extra level of protection against the hostile expert (perhaps an insider) who has gained access to the system.

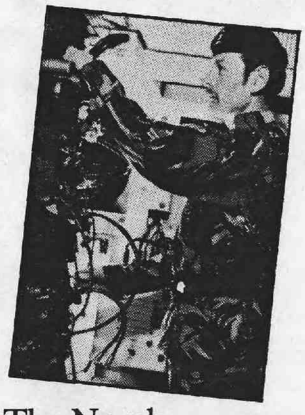
The tailorability of the ND500 will be exploited further, perhaps in specialised processors microcoded for speech or image processing.

The TTL chips, which fill 20 printed circuit boards, will be replaced with something more up to date. According to Lewis 'a gate array implementation of this architecture is already well underway and I would expect it to appear in 1986'.

Gate arrays will shrink the processor to four boards. After that, Lewis believes that with 1.25 micron silicon technology 'you can shrink it down to a couple of chips plus memory'.

It will then presumably be possible to put the kit in a small box and sell it as a single-user work station after all.

Tony Durham is a freelance journalist. ■



The Norsk architecture can provide an extra level of protection against the hostile expert who has gained access to the system